

SECTION 605 - DUPLEX SEWAGE PUMPING STATION

1. GENERAL

The Contractor shall furnish and install one factory-built, automatic pumping station. The station shall be complete with all needed equipment factory-installed in a welded steel chamber with welded steel entrance tube and with ladder to provide access.

The principal items of equipment shall include two vertical, close-coupled, motor driven, non-clog sewage pumps; valves; internal piping, central control panel with circuit breakers; motor starters and automatic pumping level controls; lighting; sump pump; ventilator; dehumidifier and all internal wiring.

2. OPERATING CONDITIONS

Each pump shall be capable of delivering _____ GPM of raw, unscreened sewage against a total dynamic head of _____ feet. The maximum allowable speed shall be _____ RPM. The minimum rated horsepower of each pump motor shall be _____.

All openings and passages shall be large enough to permit the passage of a sphere 3" in diameter and any trash or stringy material which can pass through a 4" house collection system. The anticipated operating head range is from _____ feet minimum to _____ feet maximum.

3. PUMP CHAMBER

The station shall be built by the manufacturer in two major sections, consisting of the pump chamber and the required section(s) of entrance tube. These sections shall be joined at the job site by welding. The field joint shall then be cleaned and heavily coated with epoxy resin, provided by the manufacturer. The pump chamber shall contain all pumps and other equipment and shall be a vertical cylinder of circular cross section with shell of 1/4" or heavier ASTM 283 Grade "C" steel plate, and nominal outside diameter of _____. The clear height inside from floor to motor lifting loops shall be _____ feet, inches. The bottom of the station shall be 3/8" thick structural grade steel flanged flat head with 3" flange to overlap the shell on the outside. The top of the station shall be minimum 1/4" thick structural grade steel flanged and dished head with a 1-1/2" minimum straight flange, butt welded to the station shell.

The pump chamber floor shall be reinforced from below with 8" deep structural steel beams. These beams shall be placed parallel to the suction lines and extend beyond the exterior of the pump chamber one foot, to act as skids and to protect the protruding suction lines during shipment and installation.

The domed head shall contain a suitable transition of the entrance tube. This transition shall be constructed so that the entrance tube is plumb when the station is installed, with the floor sloped for drainage in accordance with the manufacturer's installation instructions. Lifting eyes adequate to support the entire weight of the completed chamber shall be provided and welded to the station head.

A 20" diameter by 8" deep sump with walls of 1/4" structural-grade steel plate shall be provided in the position shown on the drawing.

Where the cast iron suction and discharge lines pass through the station walls, they shall be reinforced with 1/4" thick steel sleeves, welded inside and out to the station wall. The space between the cast iron pipes and the steel sleeves shall be packed tight with portland cement grout containing "Embeco" aggregate to prevent leakage. A box sub-base made of 1/4" thick steel plate shall be welded to the floor of the pump chamber for each pump. A lifting loop shall be located on the ceiling over each pump so a pulley or hoist can be attached for service work.

4. ENTRANCE TUBE

The entrance tube shall be provided in one or more sections, as required, with ladder and cover. The tube shall be a vertical cylinder, made from 1/4" structural-grade steel plate, rolled to ___ diameter.

The length shall be adequate to place the cover above the surrounding ground and anticipated local flooding.

The entrance tube shall be stiffened at the bottom end and at the top by a 3/4" square bar, rolled to match the outside of the tube and securely welded thereto. The bottom stiffener bar shall rest on a 1-1/2" x 1/4" angle, shop welded to the transition in the head of the pump chamber. Two lifting lugs shall be provided on each section of entrance tube for handling and installation.

The entrance tube cover shall be of fiber glass reinforced plastic and shall have a reflective color to reduce heat absorption. The cover shall have a suitable drip-lip around the edge and shall be provided with a weatherproof lock of the pin tumbler type which can be opened from the inside without a key. The lock shall be self-locking upon slamming the lid. The fiber glass cover shall be fastened to a steel ladder, having two rungs which form an extension of the access ladder when the cover is latched in the open position. The steel ladder is hinged and has a latch mechanism to keep the cover open under any normal load. A continuous-mold neoprene gasket shall be provided on the top of the tube to seal the cover and protect the top edge of the entrance tube.

The access ladder shall have rungs of 1" outside diameter aluminum pipe, spaced on 12" centers. Air vent ducts of 3" x 4" rectangular steel tubing shall form the side rails.

The ladder section in the entrance tube shall be lined up accurately with the section in the pump chamber by self-aligning projections from the upper vent ducts. Neoprene rubber sleeves shall be provided to seal the joint between the adjoining vent sections.

5. WELDING

All steel structural members shall be joined by electric arc welding with welds of adequate section for the joint involved. Where required, to exclude ground water or for structural reasons, such welds shall be continuous and watertight.

6. PROTECTION AGAINST CORROSION

After welding, all inside and outside surfaces of the structure shall be blasted with steel grit to remove rust, mill scale, weld slag, etc. All weld spatter and surface roughness shall be removed by grinding. Immediately following cleaning, a single heavy inert epoxy

resin coating shall be factory applied to all inside and outside surfaces prior to shipment. The dry coating shall contain a minimum of 85% epoxy resin with the balance being pigments and thixotropic agents.

A touch-up kit shall be provided for repair of any mars or scratches occurring during installation. This kit shall contain detailed instructions for use and shall be a material which is compatible with the original coating. The touch-up coating shall contain a minimum of 85% epoxy resin.

Two 17-pound magnesium anodes shall be provided for cathodic protection. The anodes shall be provided with minimum 6' long insulated copper leads. Copper lugs shall be provided by the manufacturer on opposite sides of the station for anode connections.

A heavy synthetic rubber mat shall be cemented to the station floor in the normal walkway area to protect the steel floor from abrasion.

7. PUMPS

The pumps shall be vertical, close-coupled, non-clog sewage pumps, especially designed for the use of mechanical seals. Each pump shall be of heavy, cast iron construction and shall include a vertical motor with the pump impeller mounted directly on the one-piece motor-pump shaft. The motor shall be attached to the pump volute by a one-piece cast iron adapter and backhead.

The combination pump and motor shaft shall be of solid, one-piece stainless steel from the top of the motor down through the impeller. A stub shaft to extend the motor shaft through the seal area into the impeller will not be permitted. The shaft shall be tapered where it passes through the impeller hub.

The pump shaft shall be sealed against leakage by a double mechanical seal, installed in a bronze seal housing constructed in two sections with registered fit. The housing shall be recessed into the pump backhead and securely fastened thereto with stainless steel cap screws. The inside of the seal housing shall be tapered to facilitate the replacement of the seal parts. The seal shall be of double carbon and ceramic construction, with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramics shall be held in mating position with the stationary carbons by a stainless steel spring. The seal housing, with assembled parts, shall be so constructed as to be readily removable from the shaft as a unit and shall be provided with tapped jack-screw openings to assist in removing it from the backhead.

The seal shall be pressurized and lubricated by water taken directly from the pump backhead through a filter to the seal housing and introduced between the upper and lower sealing surfaces. The filters shall be of corrosion resistant materials and shall screen out all solids larger than 50 microns. The seal system shall contain a brass valve connected near the top of the seal housing to permit the relief of any air trapped in the seal unit. A manually operated brass valve shall also be provided to vent the pump volute.

The pump impeller shall be of the enclosed type made of close-grained cast iron and shall be balanced. The impeller shall be keyed and secured to the motor-pump shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor-pump shaft and shall be readily

removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shroud. The shroud shall remain full diameter so that close, minimum clearance from shroud to volute is maintained.

The pump volute shall be of heavy, cast iron construction, free from projections that might cause clogging or interfere with flow through the pump.

The pump shall be supported by a heavy, cast iron base with four legs to provide maximum rigidity and balance. The height shall be sufficient to permit the use of an increasing suction elbow which shall be provided when the nominal pump size is smaller than the suction line. The suction and discharge openings shall be flanged, faced and drilled 125-pound American Standard.

8. MOTORS

The pump motors shall be specially built NEMA P base, open drip proof induction type, suitable for _____ phase, _____ cycle, _____ volt electric current. They shall have normal starting torque and low-starting current, as specified for NEMA Design B characteristics. The motors shall not be overloaded at the design condition, or at any head in the operating range as specified under "Operating Conditions."

Each motor shall have oversized, grease lubricated ball bearings with the thrust bearing at the bottom locked in position to eliminate shaft end-play. The motor shaft shall be solid stainless steel.

The motor pump shaft shall be centered, in relation to the motor base, within .005". The shaft run-out shall be limited to .003".

The motor shall be fitted with heavy lifting eyes, each capable of supporting the entire weight of the pump and motor.

A special varnish treatment shall be applied to the stator windings and rust preventative compounds shall be used to coat the rotor and stator air gap surfaces and protect the motor against corrosion.

9. CONTROL

The control equipment shall be mounted within a NEMA Type 1, dead-front enclosure, fabricated of steel and reinforced as required. The circuit breaker-motor starter section shall be provided with removable covers, complete with suitable latching devices. All circuit breakers, motor-starter reset buttons and pump control switches shall be mounted so that they are operable without opening the high voltage cabinet. The low voltage, automatic pump control section shall be isolated from the high voltage circuit breaker-motor starter section by a steel barrier and shall be provided with a hinged access door and latch. It shall not be necessary to open this cabinet except for adjustment of the pump level controllers. The blower timer, humidistat and thermostat shall be mounted on the face of the automatic pump control section door. A grounding type convenience duplex outlet shall be provided for operation of 115 volt AC devices.

Thermal magnetic air circuit breakers shall be provided for branch disconnect service

and over-current protection of all motor, control and auxiliary circuits. Magnetic across-the-line starters with under-voltage release and overload coils for each phase shall be provided for each pump motor to give positive protection against single phasing. Each single phase auxiliary motor shall be equipped with an over-current protection device, in addition to its branch circuit breaker, or shall be impedance protected. All switches shall be labeled and a color-coded wiring diagram shall be provided.

To control the operation of the pumps with variations of sewage level in the wet well, an air bubbler system shall be provided, complete with two air compressors, flow indicator, bubbler line to the wet well and a sensitive pressure switch for each pump.

The two air compressors shall be of the close-coupled, oil-less type. Each compressor shall have a minimum capacity of 0.2 cubic feet of free air per minute at 10 PSI. It shall incorporate a single phase, 60 cycle, 115 volt, drip-proof, brushless type, electric motor. The compressors shall be mounted on the top of the low-voltage control cabinet.

A motor driven timer shall be provided to automatically alternate the compressors every five minutes. Wiring and piping of the air compressors shall be so arranged that one compressor may be removed without removing the other compressor from service.

The pressure switches shall be of the mercury-tube type, with sensitive pressure elements and independent high and low adjustments for each pump capable of a minimum differential of 18" of water.

An automatic alternator with manual "ON-OFF" switch shall be provided to change the sequence of operation of the pumps on the completion of each pumping cycle. Provisions shall also be made for the pumps to operate in parallel, should the level in the wet well continue to rise above the starting level for the low-level pump.

10. DEHUMIDIFIER AND VENTILATING BLOWER

A dehumidifier assembly with hermetically sealed Freon refrigeration type compressor, expansion coil, fan and condenser coil shall be furnished to maintain the relative humidity of the air in the pump chamber low enough to keep the electrical equipment dry and to prevent condensation on the walls.

The moisture removing capability of the dehumidifier shall vary with the temperature and relative humidity within the station. The minimum capacity rating at 80° F. shall be 15.5 pints per day at 60% relative humidity. The maximum capacity at 80° F. shall be 25 pints per day at 90% humidity. The dehumidifier shall be controlled automatically by an adjustable humidistat and low air temperature cutout with contacts of adequate capacity for the dehumidifier motor.

The dehumidifier shall be housed in a heavy, steel enclosure at the foot of the ladder. The condensate shall be drained to the sump. Fresh air shall be drawn into the pump chamber through an air-inlet vent line which forms one side rail of the ladder. The fresh air shall be discharged directly into the inlet of the dehumidifier so that moisture may be removed before the air is circulated within the station.

A ventilating blower, housed in the dehumidifier enclosure, shall draw air from outside

the dehumidifier enclosure 18" above the floor and shall discharge it from the station through a second vent line forming the other side rail of the ladder. The squirrel-cage, high-efficiency type blower shall be controlled by a 10-minute cycle timer with a range of 0 to 100% so as to provide essentially continuous ventilation without exceeding the capabilities of the dehumidifier.

When the entrance cover is raised, the lights and ventilating blower shall be turned on automatically by a spring-operated entrance switch mounted just under the cover. A manual switch shall be mounted in the side of the duct just below the spring-operated switch for operation of the lights and ventilating blower with the cover closed. The steel vent lines shall have suitable covers to prevent the entrance of rain or snow and screened openings to prevent the entrance of rocks or other foreign matter.

11. LIGHTING

Adequate lighting, consisting of a twin 40 watt fluorescent lamp fixture shall be provided for the convenience and safety of the operator. The lighting shall provide illumination for all areas in the station. The lighting shall be controlled by the spring-operated entrance switch and a manual switch located at the top of the personnel entrance tube. The spring-operated switch shall turn the lights on automatically when the entrance lid is raised. The manual switch shall maintain the lighting circuit when the lid is closed in inclement weather.

12. SUMP PUMP

A submersible sump pump with close-coupled, vertical motor shall be installed in the sump. It shall have a minimum capacity of 1000 GPH at design head. The design head this pump will operate against is the static head from the sump to 3' below grade, plus allowance for pipe friction both inside and outside the pump chamber. A mechanical seal on the shaft shall exclude water from the motor housing.

The pump shall be controlled automatically by a built in float switch, capable of operation on a 5" differential. It shall discharge into the wet well through a 1-1/4" galvanized steel pipe, with two check valves and a gate valve within the sump chamber. An enclosure of 1/4" galvanized steel mesh shall surround the sump and the sump pump to keep out debris.

13. PIPING

Pump suction lines shall be _____", Class 150, plain end cast iron pipe, outside the pump chamber with bronze-fitted, double-disc gate valve inside the chamber. The discharge line from each pump shall be fitted with a bronze-fitted check valve and a "bronze-fitted, double-disc gate valve.

The check valves shall be of the spring-loaded lever type so that the clapper can be lifted to back flush the pump and suction line. Increasing check valves up to 6" x 8" shall have stainless steel shafts with double "O" rings and grease fittings at both ends where the shaft passes through the body of the valve. Straight-through check valves 6" and larger shall have stainless steel shaft with non-lubricated packing glands. The common discharge pipe and the discharge outlet shall be _____", Class 150, plain end, cast iron pipe.

The air bubbler line furnished by the station manufacturer in the station shall be 1/2"

nominal tubing, terminating in a fitting in the entrance tube to accept the 3/4" piping extending to the wet well. An angle bracket shall be welded to the outside of the chamber, just over the bubbler line connection, to receive a 3" x 3" x 1/4" angle brace to protect the bubbler line. A return loop in the bubbler line shall be provided to protect the station from flooding and a valve shall be provided to bleed off condensate accumulation in the air bubbler system. All steel pipe in contact with the soil or with the sewage shall be field-coated with one coat of epoxy resin after installation.

14. WIRING

The pump station shall be completely wired at the factory, except for the power feeder lines. All wiring in the pump station shall be color-coded as indicated on the wiring diagram. All wiring outside the panel shall be in conduit, except for 115 volt accessory items which are provided with connecting insulated service cord by the manufacturer. The manufacturer shall provide conduit from the control panel across the ceiling, and up the entrance tube to receive the feeder lines. The conduit shall terminate in a threaded conduit connection through the wall of the entrance tube above ground level.

Accessory items such as the sump pump, dehumidifier and air compressor shall be plugged into polarized, grounded convenience outlets, located close to their installed position so that such items can be readily removed and serviced if necessary.

15. FACTORY TESTS

The completed pump station shall be given an operational test of all equipment at the factory to check for excessive vibration, for leaks in all piping or seals and for correct operation of the automatic control system and all auxiliary equipment. The pump suction and discharge lines shall be coupled to a reservoir and the pumps shall recirculate water for at least one hour under simulated service conditions. The automatic control shall be adjusted to start and stop the pumps at approximately the levels required by the job conditions.

16. SPARE PARTS

A complete replacement pump shaft seal assembly shall be furnished with each lift station. The spare seal shall be securely fastened to the control panel and shall include complete installation instructions. A spare volute gasket shall be provided. A spare filter cone for the seal filter shall also be provided, in the same container as the pump shaft seal.

17. INSTALLATION AND OPERATING INSTRUCTIONS

Installation of the pump chamber, entrance tube and related appurtenances shall be done in accordance with written instructions provided by the manufacturer. These instructions shall be securely attached to and readily visible on the outside of the main chamber of the pump station.

The manufacturer shall further provide a complete and detailed operating and maintenance manual. The manual shall cover, in addition to general operating procedures, the operation maintenance and servicing procedures of the major individual components provided with the pump station. This manual shall be shipped with the pump station.

The manufacturer shall further provide the services of a factory-trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the owner's operating personnel in the operation and maintenance of

the equipment provided by them.

18. EXPERIENCE AND WORKMANSHIP

The pump station shall be the product of a manufacturer with a minimum of five years of experience in the design and building of such automatic, factory-built, underground pump stations and all workmanship and materials throughout shall be of the highest quality.

19. MANUFACTURED EQUIPMENT

These specifications describe a factory-built pump station as manufactured by Smith & Loveless, Inc. of Lenexa, Kansas. A factory-built pumping station of other manufacture of equal design, equipment, and materials may be offered. To receive consideration on any alternate, full descriptive material must be submitted to the City Engineer 7 days prior to date of receiving proposals by the Owner, for purposes of evaluation. The description material on any alternate must include: detailed specifications on the steel structure, corrosion protection, each item of equipment, wiring diagram, dimension prints, and a list of representative installations.

20. GUARANTEE

The manufacturer of the lift station shall guarantee for one year from date of shipment that the structure and all equipment will be free from defects in design, material and workmanship.

Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer shall be solely responsible for the guarantee of the station and all components.

In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the manufacturer shall provide a replacement part without cost to the owner. He shall further provide, without cost, such labor as may be required to replace, repair or modify major components such as the station structure, pumps, pump motors, sewage piping manifold, etc. After start-up service has been performed, the labor to replace accessory items, such as dehumidifier, sump pump, alternator, etc., shall be the responsibility of others.

The replacement or repair (including cost of parts and labor) of those items normally consumed in service, such as pump seals, fluorescent tubes, oil, grease, etc., shall be considered as part of routine maintenance and station upkeep.

21. EXTERIOR ELECTRICAL WORK

Conduit and conductors shall be extended from the connection of the sewage pump station to the top of the service pole to be furnished and set by the power company. Conduit shall terminate in a suitable weatherhead, with sufficient slack wire left for connection to the aerial secondary by others. The Contractor shall furnish and install a disconnect switch on the pole, the switch to be located approximately 5 feet above grade. The disconnect switch shall be encased in a suitable weatherproofed case, equipped with a padlock master-keyed to the same series as the lock on the pump station entrance tube cover. The power company will furnish a meter housing and meter socket to be installed by the Contractor.

22. FINAL INSPECTION

When the lift station is completed and ready to begin functioning, the Contractor shall notify the manufacturer. The manufacturer shall provide a representative who is qualified in the operation of lift stations. The representative shall place the lift station in operation, make all necessary adjustments required for proper operation and instruct the Owner's operator on the operation of the lift station.